

# The Mu3e Commissioning Run at PSI in 2025

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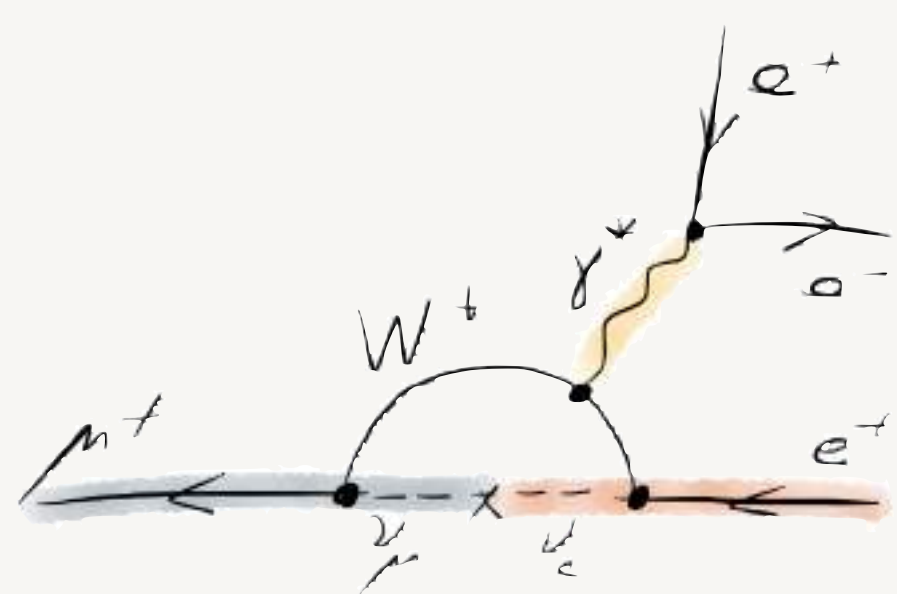
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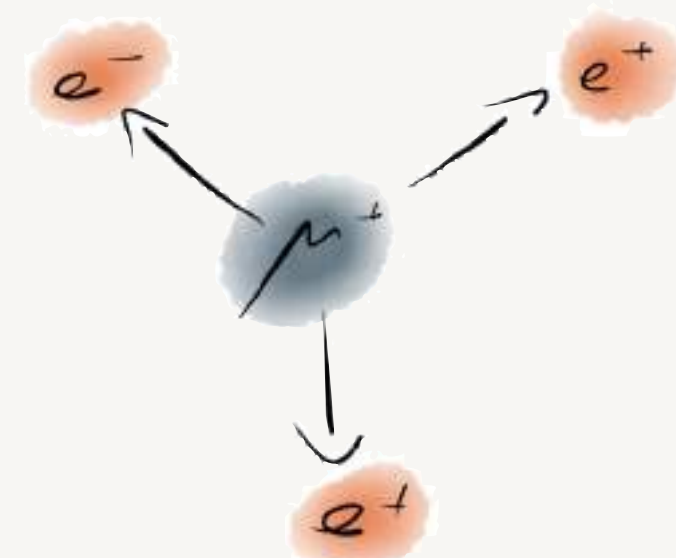


## The Mu3e experiment<sup>a)</sup>

- Searches for a charged lepton flavour violating (cLFV) decay  $\mu^+ \rightarrow e^+ e^+ e^-$
- Standard Model prediction: **BR** <  $10^{-54}$   
→ Any observation is a new physics

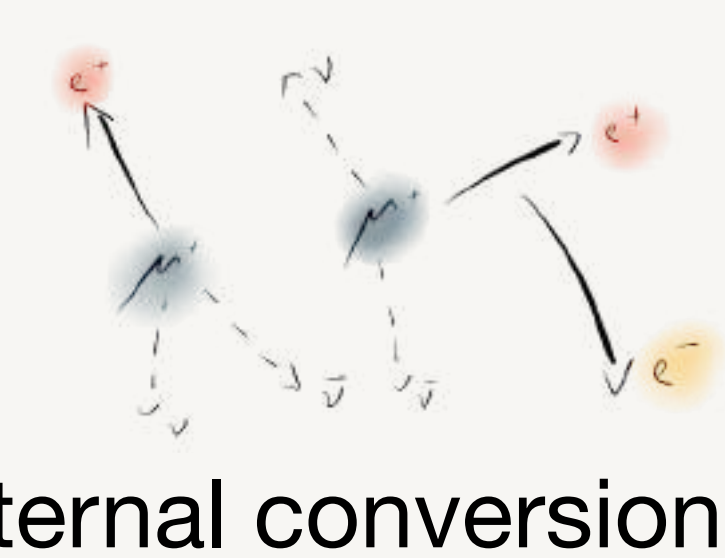


- The signal



Probe  $\mu^+ \rightarrow e^+ e^+ e^-$   
with a sensitivity of  
**BR** <  $10^{-16}$

- Accidental background



- Internal conversion

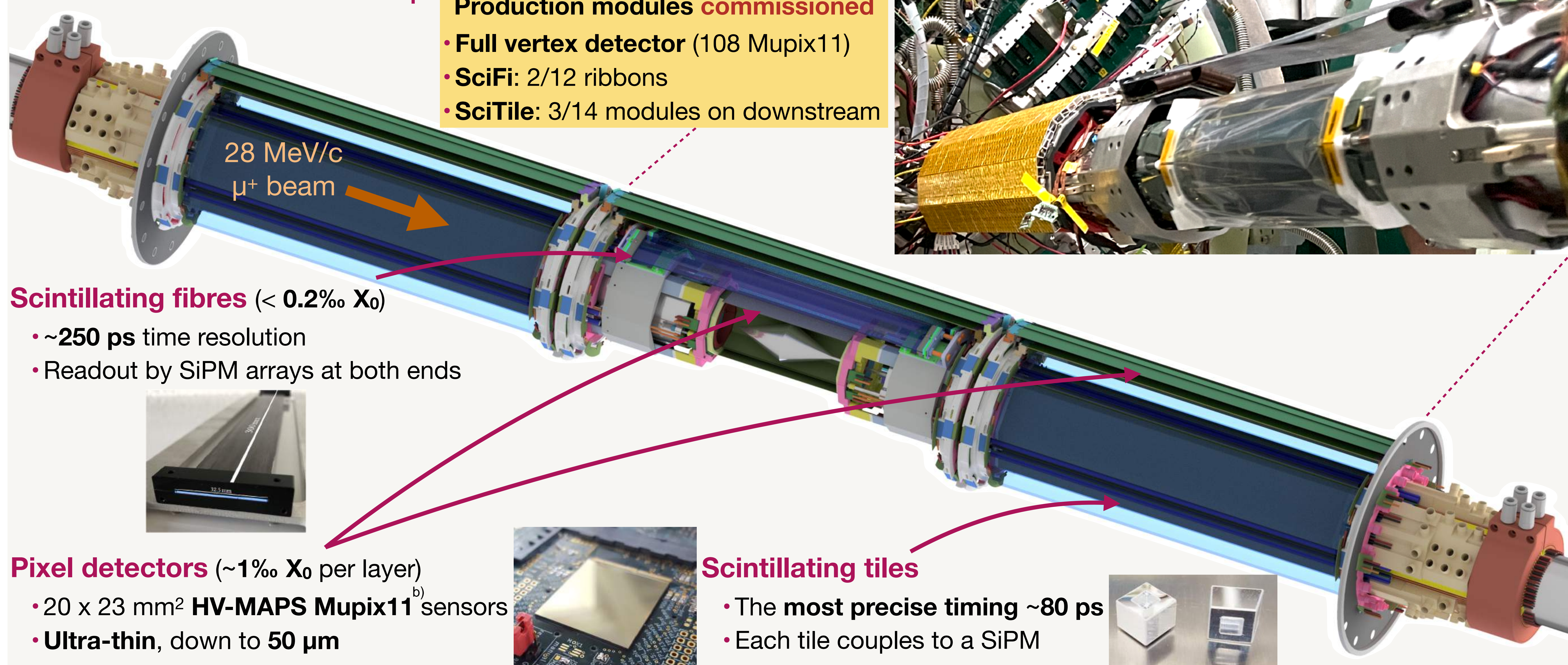


## Commissioning Run 2025

- **3-week** campaign at PSI  $\pi E5$  beamline
- First full **detector+infrastructure+DAQ** integration
- Operation in **He gas cooling**, **1 T field** and **beam** environment
- 1-week **stable data-taking** up to  **$6.5 \times 10^7 \mu^+/\text{s}$**  with **production modules**

Important milestone **achieved**  
towards **Physics Run** in 2026

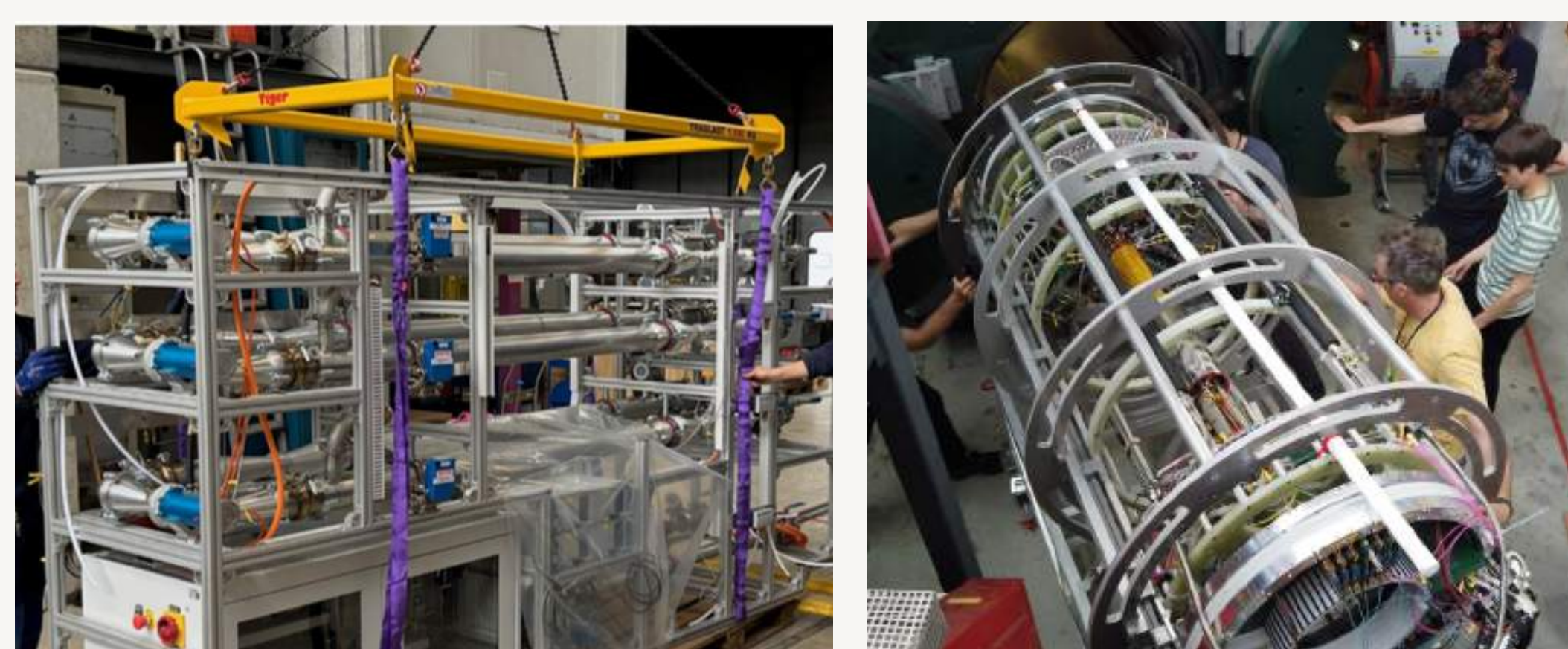
## The Mu3e detector setup



## Services

- **Gaseous helium cooling** for vertex detector
- **Liquid cooling** for SciFi and SciTile
- **Water cooling** for readout electronics
- **Powering system** for all detectors

**Final services**  
**installed and commissioned**



$\pi E5$  area  **$10^4$ - $6.5 \times 10^7 \mu^+/\text{s}$  delivered**

- Compact Muon Beam Line setup
- **Mu3e solenoid** fully operational at **1 T**

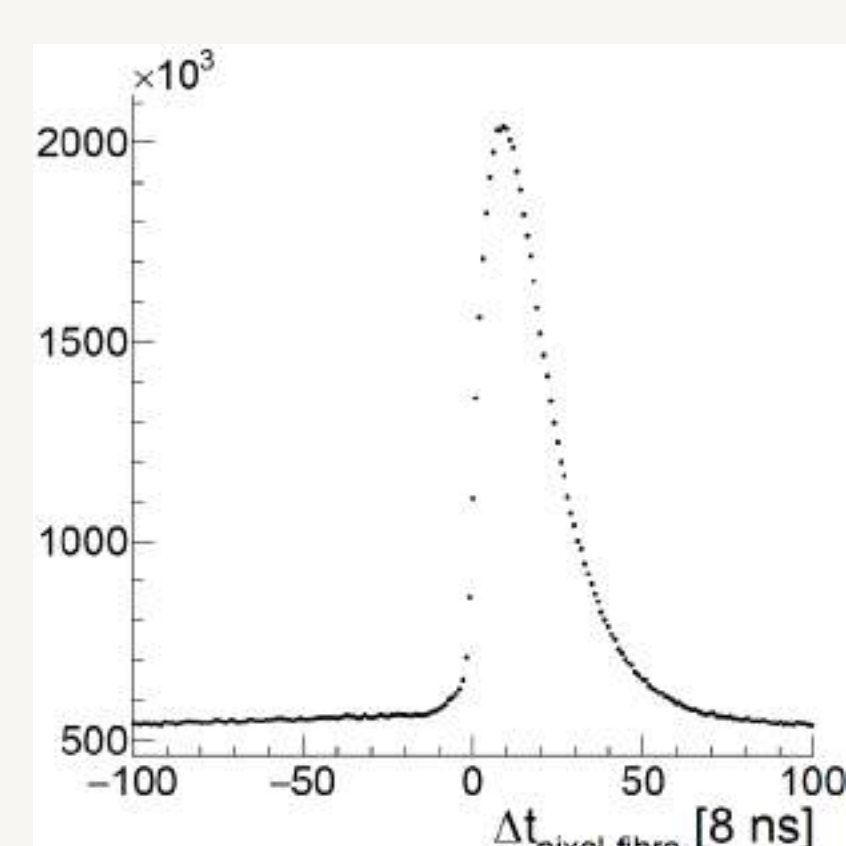


## DAQ

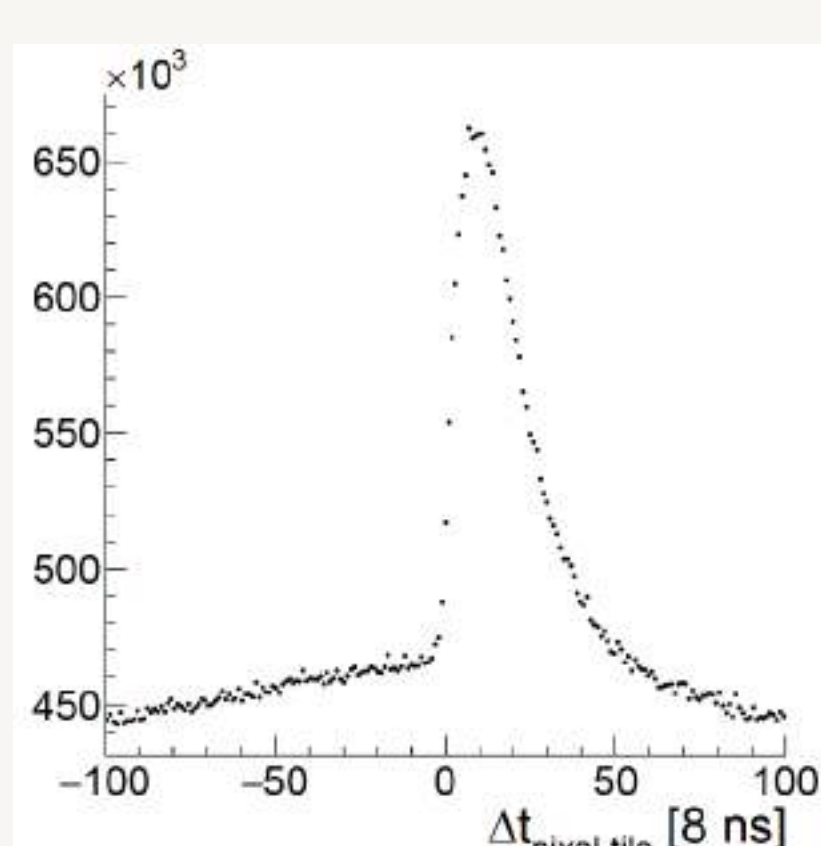
**Streaming readout demonstrated**

- **High-rate capability** with sub-detector **synchronisation**
- Online track reconstruction with **GPU filter farm**
- Online monitoring and control tools developed in **MIDAS**

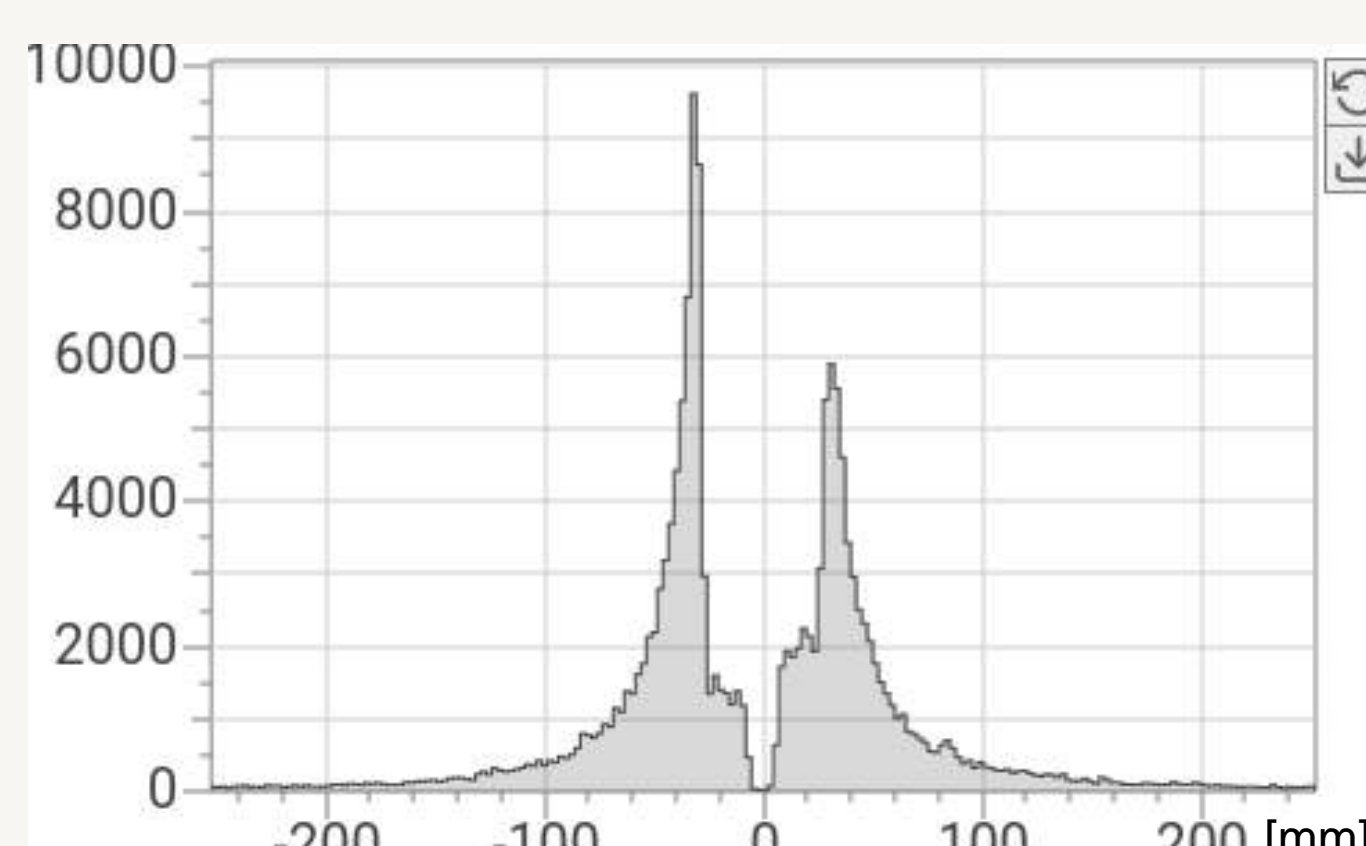
Vertex - SciFi



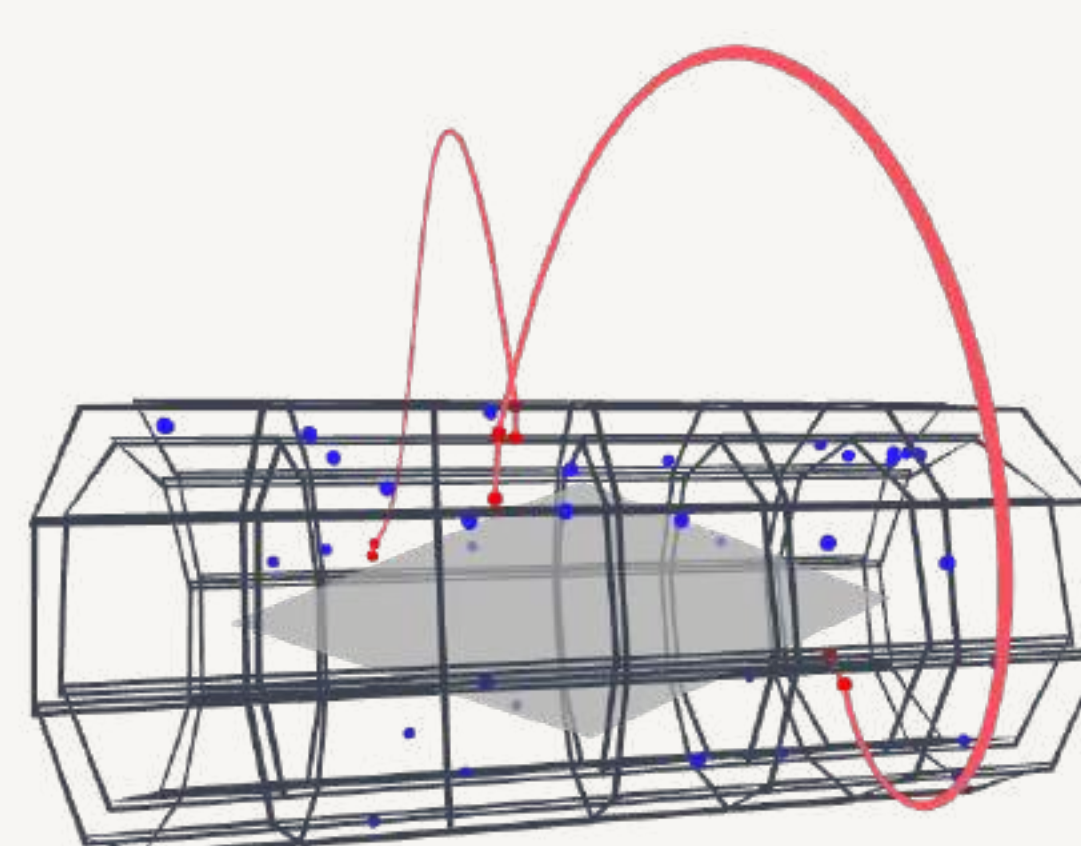
Vertex - SciTile



Transverse track radius

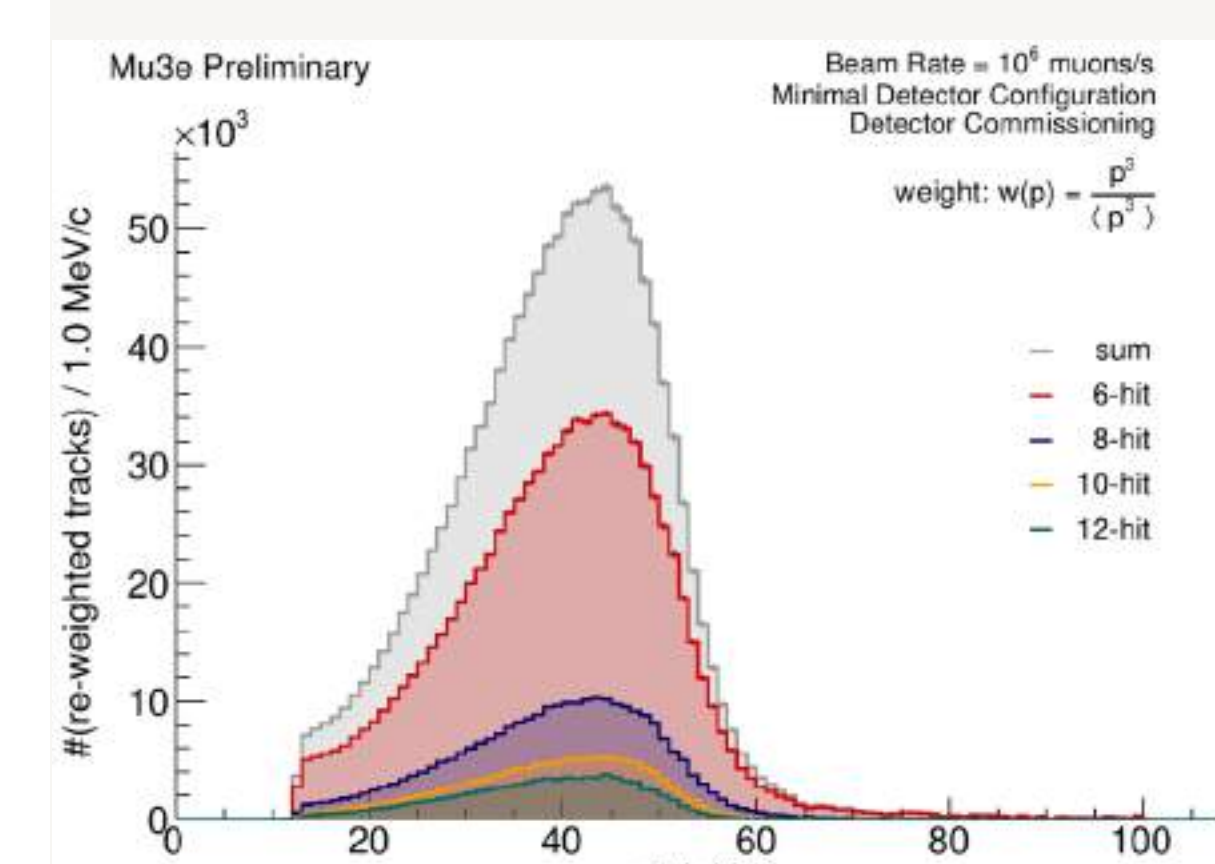


Online event display



## Ongoing analysis

- Michel spectrum
- Detector alignment
- ... and more



## References

- K. Arndt et al., "Technical design of the phase I Mu3e experiment", Nucl. Instr. Meth., A 1014 (2021) 165679.
- I. Perić, "A novel monolithic pixelated particle detector implemented in high-voltage CMOS technology", Nucl. Instr. Meth., A 582 (2007) 876.